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CLAIMS

[Claim(s)]

[Claim 1]In a machine tool which controls a machine tool body and a gantry loader by an NC unit, A work mounting table which lays a measured work in the range of said gantry loader which can be conveyed is provided, A metering device of a machine tool which installed a sensor mount by which an attitude drive is carried out, and formed a touch sensor for work contact in this sensor mount with a servo motor controlled by a five-axis-control function of said NC unit by this work mounting table outside the plane.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the metering device outside the plane which measures sizes, such as a diameter of inside and outside etc. of the work processed with the machine tool, in outside the plane.

[0002]

[Description of the Prior Art]Conventionally, in machine tools, such as a turret lathe, the diameter of a work after processing, etc. may be measured with the metering device outside the plane formed apart from the machine tool body. As this metering device outside the plane, a touch sensor is moved from a reference position to a work contact position, and there are some which measured the outer diameter of the work, etc. from the coordinates position at the time of that contact.

[0003]

[Problem to be solved by the invention]However, in the above-mentioned conventional metering device outside the plane, the control means for exclusive use is needed for the servo motor to which a touch sensor is moved, therefore composition became complicated, and there was a problem that cost increased.

[0004]The purpose of this invention has an unnecessary control means only for Measurement Division, and composition is providing the metering device of an easy machine tool outside the plane.

[0005]

[Means for solving problem]The metering device of this machine tool outside the plane is installed in the machine tool which controls a machine tool body and a gantry loader by an NC unit. In such a machine tool, the work mounting table which lays a measured work in the range of said gantry loader which can be conveyed is provided. A sensor mount is installed in this work mounting table, and an attitude drive is made to be carried out by the servo motor controlled by the five-axis-control function of said NC unit. The touch sensor for work contact is formed in this sensor mount.

[0006]

[Function]According to this composition, the attitude drive of the sensor mount is carried out until a touch sensor contacts to the processed work carried on a work mounting table with a gantry loader, and a workpiece dimension is measured based on the coordinate value at the time of that contact. In this case, the servo motor to which a sensor mount is moved is controlled using the function for one axis in the five-axis-control function of an NC unit. Therefore, the motor control means only for Measurement Division becomes unnecessary.

[0007]

[Working example]One embodiment of this invention is described based on drawing 1 thru/or drawing 3. This embodiment is an example applied to the biaxial turret lathe. As shown in drawing 2, the main part 1 of an engine lathe forms the head stock 3 which installed the two principal axes 2

side by side in the center of the bed 4, and installs the tool turret 5 in the both sides. the front shape which equipped each peripheral surface portion with a byte, a rotating rotary tool (not shown), etc. being a thing of the shape of a polygonal drum, and deducing the tool turret 5 to the each turret slide 6 -- rotation and shaft orientations (Z direction) -- it has installed movable. The turret slide 6 moves in a transverse direction (the direction of X) on the bed 4.

[0008]The gantry loader 9 it runs along with the construction rail 8 is installed above the main part 1 of an engine lathe. The gantry loader 9 forms the rise and fall shaft 11 in the back and forth movement stand 10 which moves to a cross direction (Z direction), and forms the loader head 12 in a lower end of the rise and fall shaft 11. The two loader zippers 13 are respectively formed in a field and the undersurface which counter the principal axis 2, and exchange of a position of these loader zipper 13 is enabled mutually at the loader head 12.

[0009]The metering device 14 outside the plane which measures sizes, such as an outer diameter of the processed work W, by the main part 1 of an engine lathe on the left-hand side of the main part 1 of an engine lathe is formed. The gantry loader 9 performs supply of the work W from a work piece supply position which is not illustrated on the right-hand side of the main part 1 of an engine lathe to the principal axis 2, a transfer of the work W from the principal axis 2 to the work mounting table 15 top of the metering device 14 outside the plane, and taking out to a work carrying out position which is not illustrated from the work mounting table 15.

[0010]The above-mentioned work mounting table 15, the servo motor 17, the work positioning device 18, and touch sensor 19 grade are provided on the pedestal 16, and the metering device 14 outside the plane is constituted, as shown in drawing 1 and drawing 2. The servo motor 17 rotates the ball screw 20, and has the pulse coda 24.

[0011]The sensor mount 21 of a couple which separated mutually, and 21 screw in the ball screw 20 via the ball nut 22 respectively, and each sensor mount 21 is guided by the guide rod 23 arranged in parallel with the ball screw 20, and is made to move by rotation of the ball screw 20.

[0012]The touch sensor 19 is attached to each sensor mount 21, respectively.
the contact 19a passes the slit 15a formed in the work mounting table 15 -- the upper part side of the bottom to the work mounting table 15 -- ***** -- having -- ****.

[0013]Said work positioning device 18 forms the work contact part 26 at the tip of the attitude rod 25a of the attitude driving source 25 which consists of air cylinders etc., and couple arrangement is carried out so that it may counter each other in the direction which intersects perpendicularly with the moving direction of contact 19a across the middle position on the work mounting table 15.

[0014]NC unit 27 controls the whole machine tool with the programmable machine controller (PMC) 28.

Both 27 and 28. It is connected with the interface (NC/PC window) 31.

The PMC five-axis-control part 29 of NC unit 27 has a control facility of eight axes.

The control facility of seven axes of them is assigned to control of each axis of the main part 1 of an engine lathe, and the gantry loader 9.

The control facility of remainder 1 axis is used for control of the servo motor 17 of the metering device 14 outside the plane. The diameter operation program 30 of a work for measuring the outer diameter of the work W on the work mounting table 15 of the metering device 14 outside the plane is prepared for PMC28 as one of write-in programs. The loader control program which carries in a processed work to the metering device 14 outside the plane with the gantry loader 9, and the program controlled for work Measurement Division of the servo motor 17 and the attitude driving source 25 of the metering device 14 outside the plane are added to the processing program of NC unit 27.

[0015]An output of the pulse coda 24 of the metering device 14 outside the plane is fed back to the PMC five-axis-control part 29 of NC unit 27, and a detect output of the touch sensor 19 is inputted into NC unit 27 via the input device 33. An axial driving command for outside-the-plane metering-

device 14 outputted from the PMC five-axis-control part 29 of NC unit 27 is given to the servo motor 17 via the servo driver 34.

[0016]Operation of the above-mentioned composition is explained. The work W processed by the main part 1 of an engine lathe is transported by the gantry loader 9 on the work mounting table 15 of the metering device 14 outside the plane. The work W laid on the work mounting table 15 is positioned in the middle position on the work mounting table 15, as advance operation of the attitude rod 25a of the work positioning device 18 of a couple by which the placed opposite was carried out ***** by the work contact part 26 and it is shown in drawing 3 (A).

[0017]Subsequently, the sensor mount 21 is moved the right and leftward by drive of the servo motor 17 one by one until the one [the touch sensor 19] in contact with the work W. A coordinate value when one [this right going] (state of drawing 3 (B)), and ***** when one [the left going] are respectively read in a detection value fed back to the PMC control section 29 from the pulse coda 24 of the servo motor 17. An outer diameter of the work W calculates according to a difference of these coordinate values.

[0018]As compared with an outer diameter of a master work which was measured beforehand and memorized, data transfer of this calculated diameter of a work is carried out to a tool correcting function part in NC unit 27 in quest of that difference. Thereby, amendment of a tool position is performed at the time of processing of the following work W, and improvement in process tolerance is achieved.

[0019]The work W which finished Measurement Division is taken out to a predetermined work carrying out position by the gantry loader 9. In the metering device 14 outside the plane which Measurement Division ended, the work positioning device 18 and the touch sensor 19 retreat to the original position in readiness.

[0020]Since the servo motor 17 for movement of the touch sensor 19 was controlled using a five-axis-control function in which NC unit 27 remained in this way according to this metering device 14 outside the plane, a motor control means only for Measurement Division is unnecessary, and structure becomes easy. And since the gantry loader 9 is used also [carrying in/out / of the work W to the metering device 14 outside the plane], it is unnecessary to form carrying in/out equipment for exclusive use for metering devices, and composition becomes easy also by this. In the metering device 14 of this embodiment outside the plane, since the work positioning device 18 which has the work contact part 26 of a V type is formed and a position of the work W is fixed, a diameter of a work is measurable with sufficient accuracy only by not moving the touch sensor 19 in the biaxial direction, and making it move to 1 shaft orientations. Therefore, both structural composition and an operation program of a diameter of a work will become easy.

[0021]Although the above-mentioned embodiment explained the example which measures the outer diameter of the work W, it may be made to measure the inside diameter by making the inner circumference side of the work W face contact 19a of the touch sensor 19, as while shows drawing 4, and calculating each coordinate value with which contact 19a is equivalent to the both ends of an inside diameter.

[0022]Width Measurement Division of the work W can also be performed by laying the work W on the work mounting table 15 with the posture which becomes parallel [the axis] to the ball screw 20, as shown in drawing 5.

[0023]

[Effect of the Invention]The metering device of the machine tool of this invention outside the plane in the range of a gantry loader which can be conveyed. Provide the work mounting table which lays a measured work, and to this work mounting table. Since the sensor mount by which an attitude drive is carried out was installed and the touch sensor for work contact was formed in this sensor mount with the servo motor controlled by the five-axis-control function of an NC unit, only by using one axis in the five-axis-control function of an NC unit, Work Measurement Division can be performed without preparing the control means only for an outside-the-plane metering device. Therefore, a

metering device outside the plane can be constituted simply and inexpensive. Since a part of five-axis-control functions are made to remain among the five-axis-control function in many cases, without using it when using a commercial NC unit as a five-axis-control means of the whole machine tool especially, By using the surplus five-axis-control function as a control means of the above-mentioned metering device outside the plane, the control facility of an NC unit can be used effectively.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a key map showing the composition of the metering device of one embodiment of this invention outside the plane.

[Drawing 2]It is a front view showing the composition of the machine tool in which the embodiment is applied.

[Drawing 3]It is an explanatory view showing operation of the metering device outside the plane.

[Drawing 4]It is an explanatory view showing operation of the work inside diameter Measurement Division by the metering device outside the plane.

[Drawing 5]It is an explanatory view showing operation of the work width Measurement Division by the metering device outside the plane.

[Explanations of letters or numerals]

1 [-- A metering device outside the plane,] -- The main part of an engine lathe, 2 -- A principal axis, 9 -- A gantry loader, 14 15 [-- A work positioning device, 19 / -- A touch sensor, 20 / -- A ball screw, 21 / -- A sensor mount, 22 / -- A ball nut, 24 / -- Pulse coda, 27 / -- An NC unit, 30 / -- Diameter operation program of a work] -- A work mounting table, 15a -- A slit, 17 -- A servo motor, 18

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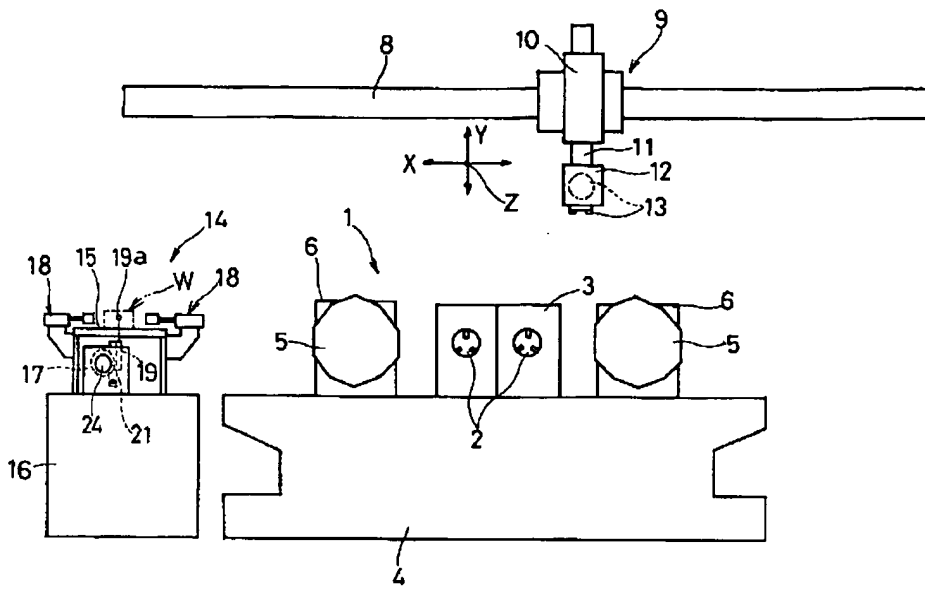
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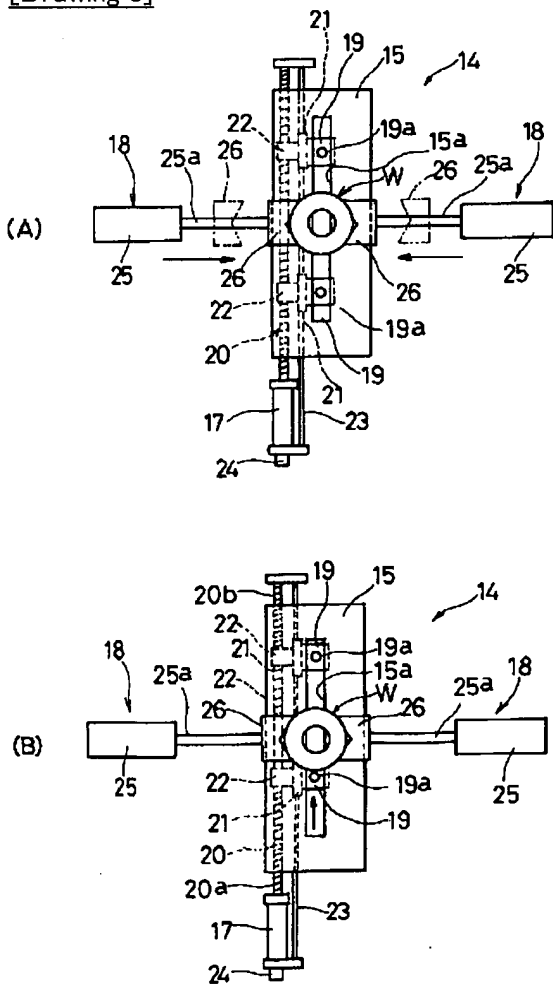
DRAWINGS

[Drawing 1]

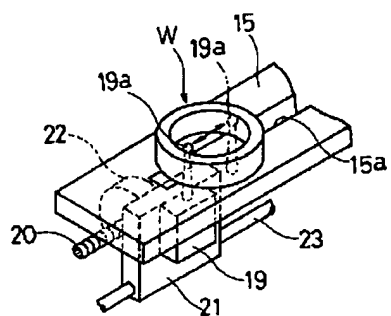




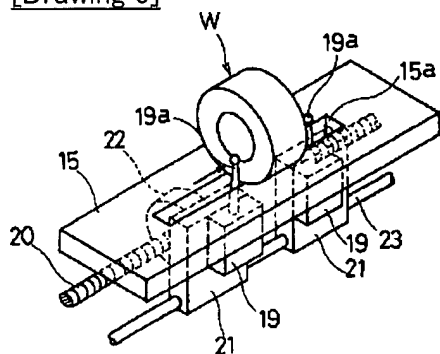
[Drawing 3]



[Drawing 4]



[Drawing 5]



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CORRECTION OR AMENDMENT

[Kind of official gazette]Printing of amendment by regulation of Patent Law Article 17 of 2
 [A section Type] The 3rd Type of the part II gate
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[Written Amendment]
 [Filing date]Heisei 9(1997) June 16
 [Amendment 1]
 [Document to be Amended]Description
 [Item(s) to be Amended]Claims
 [Method of Amendment]Change
 [Proposed Amendment]
 [Claim(s)]

[Claim 1]A metering device of a machine tool which provided a work mounting table which lays a processed measured work in a machine tool controlled by an NC unit, and formed a touch sensor for work contact by which an attitude drive is carried out with a servo motor controlled by a five-axis-control function of said NC unit by this work mounting table outside the plane.

[Claim 2]A metering device of the machine tool according to claim 1 which provided said work mounting table which constitutes said machine tool with a machine tool body and a gantry loader, and lays a measured work in the range of said gantry loader which can be conveyed outside the plane.

[Claim 3]Establish a work positioning means which positions a measured work laid on said work mounting table to one way, and said touch sensor, A metering device of the machine tool according to claim 1 or 2 which is what carries out forward/backward moving to a central direction of a measured work which said one way aims to differ and was positioned by said work positioning means

outside the plane.

[Amendment 2]

[Document to be Amended]Description

[Item(s) to be Amended]0005

[Method of Amendment]Change

[Proposed Amendment]

[0005]

[Means for solving problem]In the machine tool by which the metering device of this machine tool outside the plane is controlled by an NC unit, The work mounting table which lays a processed measured work is provided, and the touch sensor for work contact by which an attitude drive is carried out with the servo motor controlled by the five-axis-control function of said NC unit by this work mounting table is formed. It is also what provided said work mounting table which constitutes said machine tool with a machine tool body and a gantry loader, and lays a measured work in the range of said gantry loader which can be conveyed. The work positioning means which positions the measured work laid on said work mounting table to one way is established, and forward/backward moving of said touch sensor is carried out to the central direction of the measured work which aims to differ from said one way and was positioned by said work positioning means.

[Amendment 3]

[Document to be Amended]Description

[Item(s) to be Amended]0006

[Method of Amendment]Change

[Proposed Amendment]

[0006]

[Function]According to this composition, to a processed measured work, the attitude drive of it is carried out until a touch sensor contacts, and a workpiece dimension is measured based on the coordinate value at the time of that contact. In this case, the servo motor to which a touch sensor is moved is controlled using the function for one axis in the five-axis-control function of an NC unit. Therefore, the motor control means only for Measurement Division becomes unnecessary. A measured work is carried to a work mounting table by a gantry loader from a machine tool body, and Measurement Division is performed. The work mounting table is provided in the range of a loader which can be conveyed. A measured work is laid on a work mounting table, and after being positioned by a work positioning means in one way, when said touch sensor aims to differ from said one way and carries out forward/backward moving to the central direction of a measured work, work Measurement Division is performed.

[Amendment 4]

[Document to be Amended]Description

[Item(s) to be Amended]0023

[Method of Amendment]Change

[Proposed Amendment]

[0023]

[Effect of the Invention]In the machine tool by which the metering device of the machine tool of this invention outside the plane is controlled by an NC unit, Since the work mounting table which lays a processed measured work was provided and the touch sensor for work contact by which an attitude drive is carried out with the servo motor controlled by the five-axis-control function of said NC unit by this work mounting table was formed, Work Measurement Division can be performed only by using one axis in the axial function of an NC unit, without preparing the control means only for an outside-the-plane metering device. Therefore, a metering device outside the plane can be constituted simply and inexpensive. Since a part of especially five-axis-control functions are made to remain among the five-axis-control functions as the whole machine tool in many cases, without using it, the control facility of an NC unit can be effectively used by using the surplus five-axis-control function

as a control means of the above-mentioned metering device outside the plane. When said work mounting table which constitutes said machine tool with a machine tool body and a gantry loader, and lays a measured work in the range of said gantry loader which can be conveyed is provided, In order that the gantry loader which performs carrying in/out of a work to a machine tool body may perform carrying in/out of a work also to a metering device outside the plane, it is unnecessary to form the carrying in/out equipment only for a metering device, and it becomes easy also by this to constitute it. Establish the work positioning means which positions the measured work laid on said work mounting table to one way, and said touch sensor, When it constitutes so that forward/backward moving may be carried out to the central direction of the measured work which aims to differ from said one way and was positioned by said work positioning means, the diameter of a work can be measured with sufficient accuracy only by not moving a touch sensor in the biaxial direction and making it move to one way. Therefore, both structural composition and the operation program of the diameter of a work can be simplified.

[Translation done.]